

REMARKS

Claims 42-70 remain pending in the present application. Claims 54-67 were objected to by the Examiner as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form to include the limitations of the base claim and any intervening claims. New claims 71-77 have been presented by Applicant for consideration by the Examiner and are believed to be directed to patentable subject matter. Applicant appreciates the Examiner's consideration of the Application.

The § 103 Rejections

The Examiner rejected Claims 42, 47 and 70 under 35 USC 103 (a) as being unpatentable over U.S. Patent no. 5,931,233, issued to La Bonte, et al (hereinafter La Bonte). Applicant respectfully traverses at least for the reasons discussed hereinafter.

Initially considering the limitations of claim 4, this claim requires

selecting a detection wavelength that is emitted by the wildfire and said electrical arc and which transmits in a first way at the Earth's surface as a result of a first ratio of oxygen compounds proximate to the surface of Earth, but which detection wavelength transmits in a second way in Earth's stratosphere based on a second, different ratio of oxygen compounds present in Earth's stratosphere;

using a detection arrangement positioned such that the detection wavelength travels from said wildfire to the detection arrangement in the presence of said first ratio of said oxygen compounds and so that sunlight arriving at said detection arrangement travels through Earth's stratosphere so as to subject the sunlight to said second ratio of oxygen compounds in a way which attenuates content of the detection wavelength in the sunlight; and

configuring said detection arrangement to respond at the detection wavelength so as to enhance a detection response to the wildfire while attenuating the response to the detection wavelength in the sunlight based on said first and second ratios of said oxygen compounds.

In attempting to meet these limitations, the Examiner discusses the use of detectors by La Bonte as well as La Bonte's use of two "phases of operation" if the presence of the wildfire is identified by infrared sensors. It is noted that the relevance of this latter discussion with respect to two "phases of operation" appears to Applicant to bear little, if any reasonable relationship to the claim limitations at hand. The Examiner then admits that:

[T]he reference of La Bonte does not mention wavelength, first and second ratios of oxygen compounds as claimed by the applicant.

Having made this admission, the Examiner attempts to justify the rejection on the basis of the "two phases of operations." The Examiner goes on to say that it would be obvious to one having ordinary skill in the art to utilize the system of La Bonte for monitoring and controlling the wildfire. Applicant disagrees with this rationale, as will be discussed immediately hereinafter.

The Examiner is suggesting that La Bonte, unmodified, somehow teaches Applicant's claimed combination by the use of two phases of operation. The Examiner, however, has admitted that La Bonte fails to teach, suggest or reasonably disclose Applicant's claim limitations, relating to the detection wavelength. It is well-settled that the mere fact that the prior art could be modified to produce the claimed invention would not make the modification obvious, unless the prior art suggested the desirability of the modification. Applicant, however, finds no reasonably related suggestion in La Bonte. The mere use of two phases of operation by La Bonte falls substantially short of any reasonable suggestion relating to the selection of a detection wavelength, as claimed. Further, it is well-settled that a rejection under § 103, based on modification of a reference, cannot be sustained unless the particular modification is suggested by the prior art itself. If the examiner cannot point to a teaching in the art which supports the combination or modification, the rejection is unfounded. Applicant respectfully submits that La Bonte is devoid of any reasonable suggestion of a modification that would result in the claimed combination. Further, Applicant finds nothing in La Bonte which would reasonably motivate one of ordinary skill in the art to make the modification that is being proposed. In this regard, the Examiner suggests that it would be obvious to use the system of La Bonte for monitoring and controlling a wildfire, but fails to provide a rationale as to how it would be reasonable to modify La Bonte in a way which causes one to arrive at the claimed combination. Accordingly, for at least these reasons, Applicant respectfully submits that Claim 42 is allowable over La Bonte.

Claim 47 is an independent claim that includes the limitations of claim 42, but in apparatus form. Accordingly, Applicant considers that the arguments made above, in favor of the patentability of claim 42 over La Bonte, are equally applicable with respect to the patentability of claim 47 over La Bonte. Moreover, the rejection of claim 47 is framed on the basis of the rejection of claim 42, as discussed above. Hence, for at least these reasons, allowance of claim 47 is respectfully requested.

Claim 70 is an independent claim which recites:

In a method for long-range detection of at least one of wildfires and electrical arcing from a location that is proximate to the Earth's surface, the improvement comprising:
selecting a detection wavelength that is emitted by a flame of said wildfire, said electrical arcing, and the Sun such that the detection wavelength is substantially blocked on propagation through the Earth's stratosphere as compared to propagation of the detection wavelength through the Earth's troposphere.

With respect to this rejection, the Examiner again discusses La Bonte as teaching two phases of operation and asserts that the claim limitations are somehow obvious on the basis of using La Bonte, while still admitting that La Bonte does not teach Applicant's wavelength selection. Applicant respectfully disagrees. As discussed above with respect to the rejections of claim 42 and 47, a § 103 reference is ineffective with respect to claim limitations that are not reasonably suggested by the reference. Hence, the arguments made above, in favor of the patentability of claim 42 over the art of record, are considered to be equally applicable with respect to the patentability of claim 70. Clearly, La Bonte fails to teach, disclose or reasonably suggest the wavelength selection limitations of claim 70 and would provide no reasonable motivation with respect to a modifying La Bonte in a way which would encompass the subject limitations. Accordingly, for at least these reasons, allowance of claim 70 is respectfully requested.

The Examiner rejected claims 43-46, 48-53, 68 and 69 under 35 U.S.C. § 103(a) as being unpatentable over La Bonte in view of a Hamamatsu Flame sensor UV TRON R2868 document (hereinafter the UVT I document). Applicant respectfully disagrees, as will be discussed below. Further, in support of this discussion, Applicant has submitted herewith a Supplemental IDS which includes another Hamamatsu document entitled "UVTron Characteristics and Methods of Use" (hereinafter the UVT II document), as will be referred to at appropriate points hereinafter.

Claims 43-46, 68 and 69 each depend either directly or indirectly from and therefore include the limitations of claim 42. Accordingly, it is respectfully submitted that each of these claims is also patentable over the art of record for at least the reasons set forth above with respect to claim 42. Moreover, it is submitted that the UVT I document contributes nothing to the basis of the § 103 rejection of claim 42, as discussed above. Further, each of these dependent claims places additional limitations on their parent and intermediate claims which, when considered in light of claim 42, further distinguish the claimed invention from the art of record.

Initially considering claim 43, this claim requires that the detection wavelength is selected within a wavelength range between 230 and 280 nm, which wavelength range is (i) contained by sunlight, (ii) substantially blocked when the sunlight passes through the Earth's stratosphere and (iii) travels through the atmosphere at the surface of the Earth so as to provide for a high sensitivity of the detection arrangement to the wildfire and the electrical arc. The UVT I document, on the other hand, merely discloses a detector having a spectral response from 185 nm to 260 nm. Figure 4 of the UVT II document illustrates logarithmic responses for three different cathode materials including nickel, tungsten and molybdenum. It is noted that the device of UVT I includes a nickel cathode. While each of these tubes exhibits a response in a broader range which overlaps or at least partially overlaps the recited range, Applicant points out that the mere availability of a detector having a response that is broader than or partially overlaps the recited range fails to teach, disclose or reasonably suggest the advantages that are provided by Applicant's method.

Applicant has recognized that the selection of a wavelength in the claimed range causes an enhanced response by providing a high sensitivity of the detection arrangement to the wildfire and electrical arc, while relying on transmission of the detection wavelength, present in sunlight, in the Earth's lower atmosphere, but attenuation of the detection wavelength in the upper atmosphere. In this regard, the peak of the UVC radiation from a distant wildfire is near 250 nm, as described in paragraph 11 of Applicant's disclosure, within the recited range. Applicant finds no teachings in the UVT I or UVT II documents with respect to the detection of a wildfire. Applicant, however, has recognized that the response of the R2868 is unacceptably low for the UVC band that is transmitted well by the lower atmosphere so as to be essentially useless, as the device is described by the UVT I document. Figure 4 of the UVT II document better illustrates that the response for a nickel cathode drops off dramatically above 230 nm. It is apparent in figure 4 that the response for the nickel cathode is only 10% at 230 nm, less than 0.5% at 250 nm, and appears that it would continue its rapid drop above 250 nm, although the plot ends at this wavelength. In this regard, it is thought that the plot is terminated at 250 nm due to unpredictable residual response that results from cathode defects, as discussed elsewhere in this response. The tungsten and molybdenum cathode responsivities, on the other hand, overlap the sunlight curve to such an extent that the sunlight dramatically overwhelms wildfire and electrical arc emissions at those wavelengths, thereby rendering the output of those tubes essentially useless with respect to reasonably discriminating the wildfire or electrical arc emissions, as will be further discussed below. Thus, the response for

the nickel cathode curve is too attenuated and unpredictable in the desired range, while the response for the tungsten and molybdenum curves introduce excessive solar energy. Clearly, no motivation is provided for selecting a wavelength in the claimed range by either the UVT I or UVT II documents.

Still considering figure 4 of the UVT II document, the three curves using different cathode materials, along with related discussions are believed to confuse matters with respect to any reasonable teaching of the subject claim limitations. For example, at the second column, penultimate paragraph, on page 3 of the UVT II document, a statement is made to the effect that the nickel cathode exhibits "good solar blind characteristics." Accordingly, it is submitted that one of ordinary skill, in attempting to discriminate the extremely weak emissions from a distant wildfire or electrical arc would be motivated to look elsewhere, since more than merely "good solar blind characteristics" are needed. The molybdenum cathode tube is described in the last paragraph of this column as being suitable for burner monitoring where exterior light such as sunlight does not enter directly. Clearly, this solar response is unacceptable, inasmuch as the document is essentially providing a warning not to use the device for flame detection in the presence of sunlight. It is submitted that one of ordinary skill would immediately abandon any attempt to use this device for Applicant's purposes in view of this statement alone. The response of the tungsten cathode is described at the top of column 1 of page 3 in the UVT II document and is merely described as "suitable for burner monitoring." One having ordinary skill is still further discouraged by a discussion of ambient light which appears at the bottom of col. 2, page 10 of the UVT II document which describes cathode defects as causing residual sensitivity beyond the cutoff wavelength. In this regard, it is noted that Applicant's photo-annealing technique, which is addressed by certain ones of claims 54-67 and fully described in Applicant's specification (that the Examiner appears to consider as allowable), resolves the problem of cathode defects. The following statement is then made:

Therefore, a strong, direct incident light such as that from a fluorescent lamp may induce erratic discharge.

Since sunlight can be much stronger than fluorescent lamp light, Applicant submits that this statement evidences no recognition of Applicant's method as embraced by claim 43. Clearly, one having ordinary skill in the art would be provided no motivation to rely on any teachings in the UVT I and II documents in arriving at Applicant's claimed combination, when the sunlight may be of an intensity that is thousands of times stronger than the target wildfire and electrical arc emissions from 230 nm to 280 nm. Further, the UVTron devices are sensitive to numerous non-flame outdoor sources which include, for example, lightning, arc welders, sparking motors and halogen lamps. Hence, it is respectfully submitted that the art of record, in any reasonable combination, fails to teach, disclose or suggest the combined limitations of claim 43. Accordingly, for all of the forgoing reasons, allowance of claim 43 is respectfully requested.

Claim 44 requires that the detection arrangement is configured for a high sensitivity to the wavelength range between 230 nm to 280 nm and for a reduced sensitivity to a wavelength longer than 280 nm such that the detection arrangement is essentially solar blind above 280 nm where said reduced sensitivity is less than said high sensitivity. It is submitted that the UVT I document provides no motivation for configuring a detection arrangement in this manner. In particular, the described detector tube of the UVT I document exhibits approximately 99% of its response below 230 nm. It does not exhibit high sensitivity in the recited range, but rather a very pronounced peak near 200 nm. In Applicant's view, the

presence of this peak, well below the UVC peak that is emitted by a wildfire, introduces considerable difficulties with respect to using the detector tube of the UVT I document in the claimed technique. Overcoming these difficulties was neither trivial nor obvious. Further, as evidenced by the discussion of the UVT II document above, none of the described cathode materials provide what could be reasonably considered as an essentially solar blind response above 280 nm. Accordingly, for at least these reasons, allowance of claim 44 is respectfully requested.

Claim 45 requires configuring the detection arrangement to include a wide angular sensitivity. In this regard, it is noted that paragraph 7 of Applicant's disclosure describes using filters in attempting to provide an appropriate wavelength response in conjunction with wide angular sensitivity. Unfortunately, however, no appropriate filter is available including one which might cooperate with the UVTron tube, in attempting to provide the claimed response to wavelengths longer than 230 nm, at least for the reason that the proximity of this wavelength range to the solar flux extending beyond 280 nm prohibits adequate spectral separation with either interference or absorption filters. Accordingly, for at least these reasons, allowance of claim 45 is respectfully requested.

Claim 46 requires that the detection arrangement is configured with a sensitivity within the 230-280 nm band that is at least 25 dB higher than at 280 nm and 100 db higher than at 320 nm. Applicant has found that the detector of the UVT I document does not exhibit such a response, as is discussed, for example, in paragraph 12 of Applicant's disclosure. In particular, the UVT I document describes the background noise characteristic of the detector tube to be 10 cpm maximum under room illumination and operating conditions. Since the background noise characteristic further worsens in sunlight conditions, this background noise characteristic, as supplied by the manufacturer, is clearly unacceptable in detecting the presence of wildfire and electrical arcs at long distances. It is thought that this response is produced by the residual sensitivity of the device above its cutoff wavelength, as discussed above. In this regard, with respect to the plots of figure 4 of the UVT II document, the response for each material is not shown above each cutoff wavelength, since as discussed above, it is believed to be too unpredictable to plot due to cathode defects. Thus, these plots are indeterminate with respect to the subject claim limitations. Accordingly, for at least these reasons, allowance of claim 46 is respectfully requested.

Claim 68 recites that the detection arrangement is configured with a sensitivity for detecting a ten meter flame at a distance of 1600 meters. In this regard, the UVT II document clearly shows that approximately 99% of the native responsivity of the nickel cathode detector tube of the UVT document, which exhibits only "good" solar blindness, is at wavelengths below 230 nm. Applicant recognizes, however, that this native responsivity is of limited value for remote flame/arcing detection, because atmospheric O₂, at the Earth's surface, absorbs light at these wavelengths before it travels any appreciable distance. For example, at the UVtron's 200 nm peak response wavelength, O₂ cuts signal intensity to 1/e in just 100 meters. Further, approximately 99% of the UVtron's native responsivity is to wavelengths whose 1/e distances are less than 250 meters. These figures are based upon Applicant's analysis of a relevant portion of the USAF Handbook of Geophysics and the Space Environment, which has been provided herewith. This not only severely limits the UVtron's utility in detecting distant wildfires, but also causes a disproportionately high sensitivity to small, close flames such as those of cigarette lighters. The characteristics of the prior art tube of the UVT I document produces a stronger response to a cigarette lighter at 30 meters than the response of the device to a 10 meter flame at 1600 meters. This implies a huge potential for false alarms in response to harmless flames such as, for example, that of a cigarette lighter. In this regard, Applicant again points

out that the UVT I and II documents are silent with respect to detection of a wildfire at any range, although its response is noted in a number of specific contexts including burner monitoring, fire alarm apparatus, photoelectric counter, detection of ultraviolet ray leakage and detection of discharge phenomenon. In contrast, paragraph 47 of Applicant's disclosure describes photo-annealing of the UVTron R2868, which transforms it into a useful device for detecting wildfire at the claimed distance by eliminating solar response to the extent that a weak response to wavelengths near 250 nm is made useful and which serves, from a practical standpoint, to eliminate the residual solar response of the device by reducing cathode defects, as discussed above. It is essentially a new device, from a practical standpoint. In this regard, it is Applicant's experience that the native response of the UVTron R2868 is unacceptable for detection purposes at this range. When viewed in this light, it is apparent that the UVT I and II documents, either taken alone or in any reasonable combination with the remaining art of record, fail to teach disclose or reasonably suggest the limitations that are embraced by claim 68 wherein a detection arrangement is configured with a sensitivity for detecting a ten meter flame at a distance of 1600 meters. Accordingly, for at least these reasons, allowance of claim 68 is respectfully requested.

Claims 48-53 each depend either directly or indirectly from and therefore include the limitations of claim 47. Accordingly, it is respectfully submitted that each of these claims is also patentable over the art of record for at least the reasons set forth above with respect to claim 47. Moreover, it is submitted that the UVT document contributes nothing to the basis of the § 103 rejection of claim 47, as discussed above. Further, each of these dependent claims places additional limitations on their parent and intermediate claims which, when considered in light of claim 47, further distinguish the claimed invention from the art of record.

Claim 48 includes the limitations of claim 43, as discussed above, but in apparatus form. Accordingly, the arguments made above, with respect to the patentability of claim 43 over the art of record are considered to be equally applicable with respect to the patentability of claim 48. For example, the UVT I and II documents provide no motivation to one having ordinary skill in the art to provide a detector arrangement as claimed. For at least these reasons, allowance of claim 48 is respectfully requested.

Claim 49 includes the limitations of claim 44, as discussed above, but in apparatus form. Accordingly, the arguments made above, with respect to the patentability of claim 44 over the art of record are considered to be equally applicable with respect to the patentability of claim 49. For example, the UVT I and II documents provides no motivation to one having ordinary skill in the art to provide a detector arrangement that is capable of responding, as claimed. For at least these reasons, allowance of claim 49 is respectfully requested.

Claim 51 includes the limitations of claim 46, as discussed above, but in apparatus form. Accordingly, the arguments made above, with respect to the patentability of claim 46 over the art of record are considered to be equally applicable with respect to the patentability of claim 51. For example, the UVT I and II documents provides no motivation to one having ordinary skill in the art to provide a detector arrangement having a response to sunlight that is attenuated in the described manner. For at least these reasons, allowance of claim 51 is respectfully requested.

Claim 52 recites that the detection arrangement is characterized by a sensitivity for detecting a ten meter flame at a

distance of 1600 meters and reflects the limitations of claim 68, discussed above, but in method form. Accordingly, it is submitted that the arguments made above, in favor of the patentability of claim 68 over the art of record are equally applicable with respect to the patentability of claim 52. For at least these reasons, allowance of claim 52 is respectfully requested.

New claims 71-77 have been presented for consideration by the Examiner and are believed to be directed to patentable subject matter at least on the basis of Applicant's recognition as to the way in which a particular range of ultraviolet light is emitted by a wildfire and/or electrical arc, and which is also present in sunlight, propagates through the atmosphere of the Earth. Applicant respectfully submits that the art of record, in any reasonable combination, fails to teach, disclose or reasonably suggest the recognitions that are embraced by the language of these claims.

If the Examiner has any questions concerning this case, the Examiner is respectfully requested to contact Mike Pritzkau at 303-410-9254.

Respectfully submitted,



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